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ABSTRACT

This report provides a summary of the allocation of R&D funds and manpower among the four sectors of the economy - Federal Government, industry, universities and colleges, and other nonprofit institutions. R&D funding data include basic research, applied research, and development over the period 1953-76. Time-series data on R&D scientific and engineering manpower employed by each sector are presented for 1954-75. Highlights include: (1) total R&D spending in the U.S. is projected at $38.1 billion in 1976, 8% above the 1975 level; (2) in 1976 the U.S. is expected to devote 2.2% of its gross national product to R&D activities, down from 2.3% in 1975; (3) the Federal Government will support 53% of the total U.S. R&D effort in 1976, the same percentage as in 1975; (4) basic research spending is expected to reach $4.8 billion in 1976, an increase of 7% over 1975; and (5) the full-time equivalent of approximately 530,000 scientists and engineers were engaged in R&D activities in the U.S. in 1975, 1% more than in 1974. (Author/MH)

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FOREWORD

This report contains information from a series of National Science Foundation surveys, generally conducted on an annual or biennial basis. It provides a summary of the allocation of R&D funds and manpower among the four sectors of the economy—Federal Government, industry, universities and colleges, and other nonprofit institutions.

R&D funding data include basic research, applied research, and development over the period 1953-76. Time series data on R&D scientific and engineering manpower employed by each sector are presented for 1954-75.

The report was prepared in the Foundation's Division of Science Resources Studies, under the general guidance of Charles E. Falk, Director, and William L. Stewart, Head, R&D Economic Studies Section.

H. Guyford Stever
Director
National Science Foundation

April 1976

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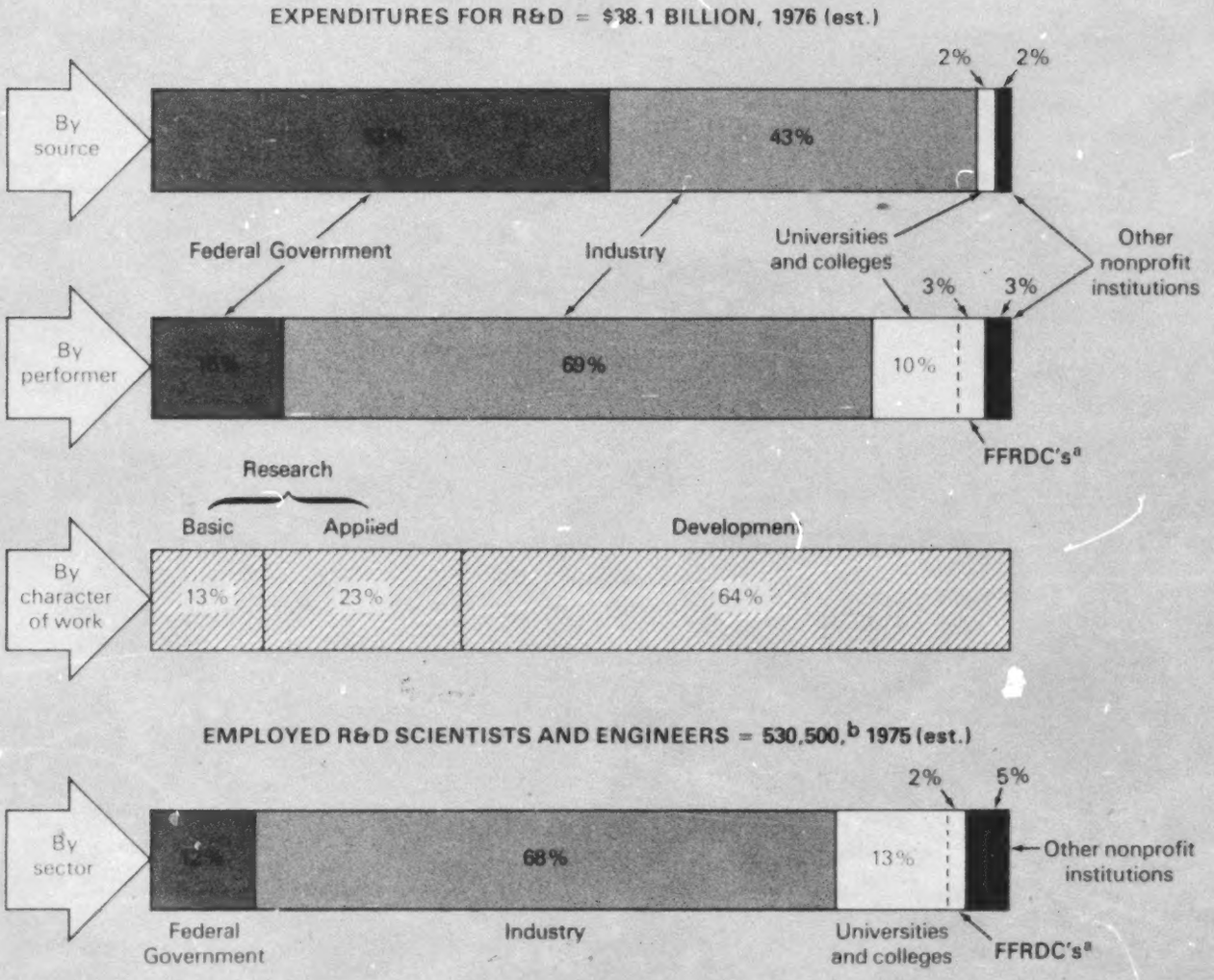
The national R&D effort



[a]Federally Funded Research and Development Centers administered by universities and colleges.
[b]Full-time equivalents.
SOURCE: National Science Foundation.

HIGHLIGHTS

- Total R&D spending in the United States is projected at $38.1 billion in 1976, 8 percent above the 1975 level of $35.2 billion. For the first time in 3 years, total R&D funds are also expected to increase in terms of constant dollars (2 percent, assuming a 6-percent rate of inflation for 1976).
- In 1976 the United States is expected to devote 2.2 percent of its gross national product (GNP) to R&D activities, down from 2.3 percent in 1975. This ratio has declined steadily from its peak of 3.0 percent in 1964, primarily as a result of the slowdown in growth of Federal R&D spending.
- The Federal Government will support 53 percent of the total U.S. R&D effort in 1976, the same percentage as in 1975. Over two-thirds of this Federal support will be in the areas of defense and space.
- Basic research spending is expected to reach $4.8 billion in 1976, an increase of 7 percent over 1975. In terms of constant dollars, funds for basic research are expected to grow 1 percent.
- The full-time equivalent (FTE) of approximately 530,000 scientists and engineers were engaged in R&D activities in the United States in 1975, 1 percent more than in 1974. This number continues to account for about one-third of the estimated total employment of scientists and engineers.

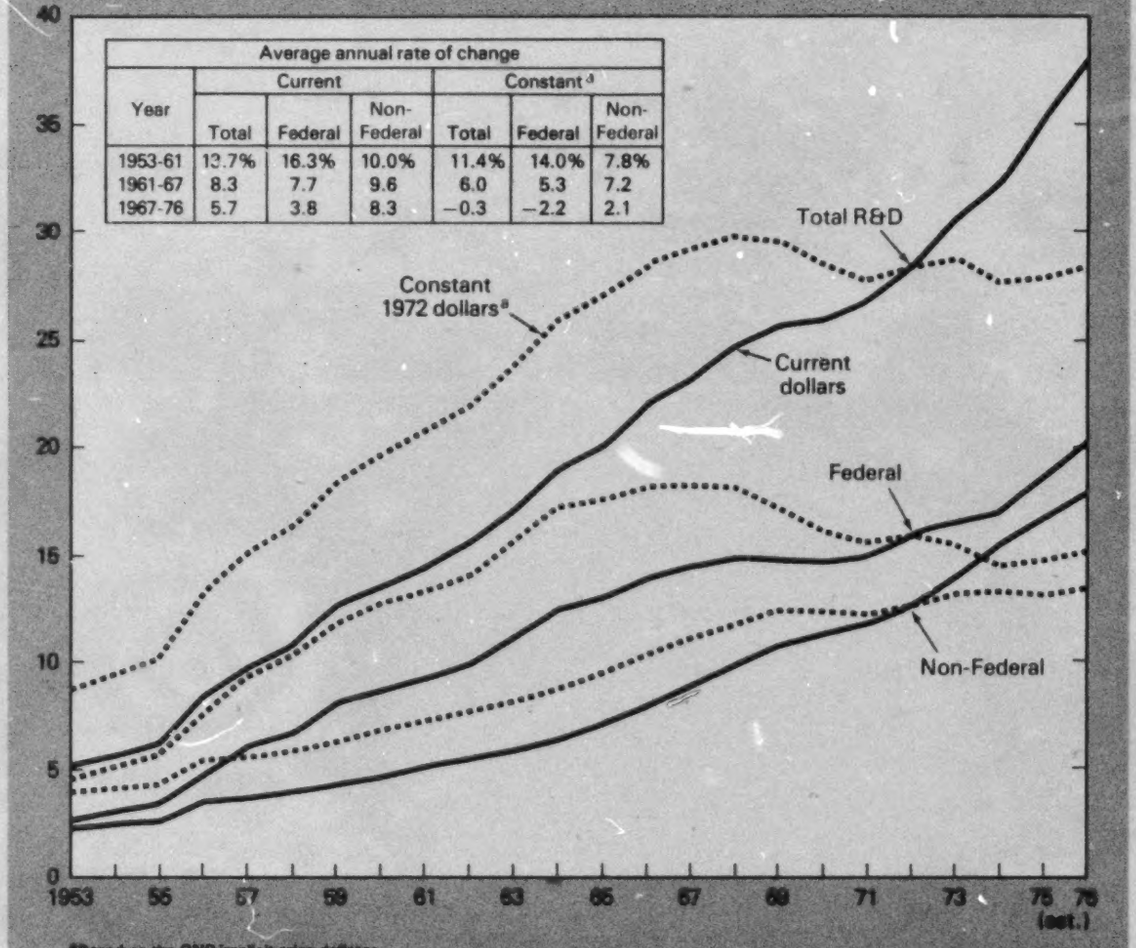
R&D FUNDING PATTERNS

Total funds for research and development in the United States are expected to reach $38.1 billion in 1976, an increase of 8 percent over the 1975 level. Measured in constant dollars, this represents a rise of 2 percent, the first constant-dollar growth in three years.[1] [2] The Federal Government is expected to spend $20.1 billion on R&D programs in 1976, 8 percent more than in the pervious year. Federal support of research and development is expected to show a 2-percent constant-dollar increase in 1976, in contrast to an average annual rate of decline of 2.2 percent since 1967. Federal R&D funds are expected to increase in the areas of defense, space, and energy, and to decrease in the field of health. Non-Federal R&D spending is also projected to increase 8 percent in 1976 to $18.0 billion.

R&D funding trends: 1953-76

(Billions of dollars)

Year	Average annual rate of change					
	Current			Constant[3]		
	Total	Federal	Non-Federal	Total	Federal	Non-Federal
1953-61	12.7%	16.3%	10.0%	11.4%	14.0%	7.8%
1961-67	8.3	7.7	9.6	6.0	5.3	7.2
1967-76	5.7	3.8	8.3	−0.3	−2.2	2.1



[a]Based on the GNP implicit price deflator
SOURCE: National Science Foundation.

[1] In the absence of a reliable R&D cost index, the gross national product (GNP) implicit price deflator was used to convert R&D expenditures to constant dollars. The GNP deflator includes the effects of price changes for all goods and services in the economy and therefore can only indicate approximate changes in cost of inputs specifically related to R&D performance.

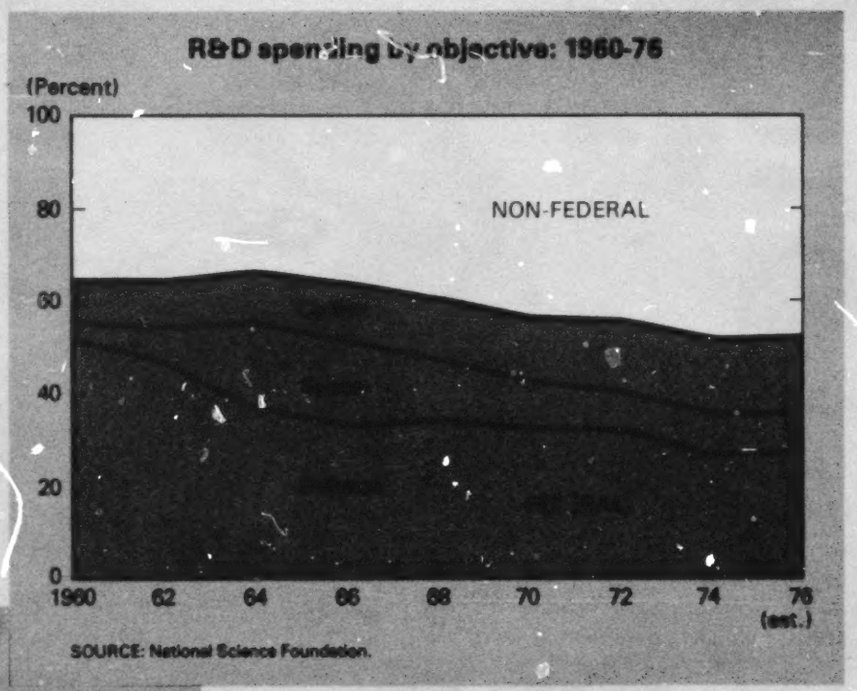
[2] Constant dollar changes assume a 6-percent increase from 1975 to 1976 in the GNP implicit price deflator. See Annual Report of the Council of Economic Advisers, *Economic Report of the President*, January 1976 (Washington, D.C. 20402: Supt. of Documents, U.S. Government Printing Office), p. 24.

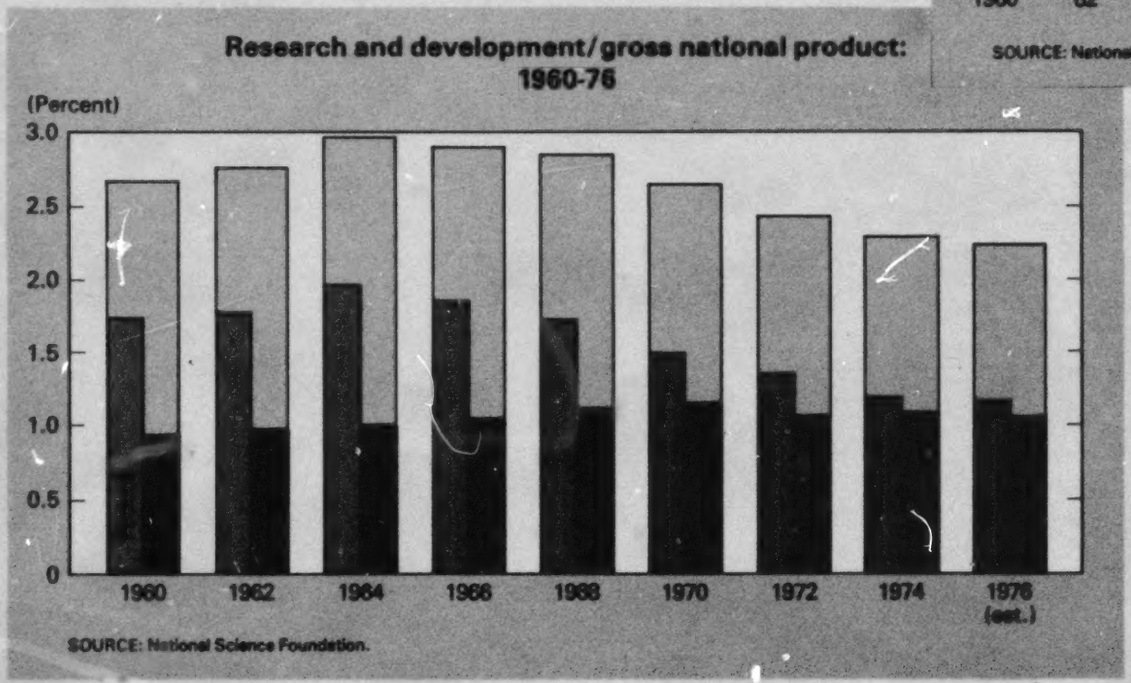
R&D by Selected Objective

For the first time since 1964, defense and space-related activities are expected to increase as a proportion of total national R&D spending, rising from 35 percent in 1975 to 36 percent in 1976. Defense spending accounted for all of the increase. Actual expenditures for defense and space-related research and development are estimated at $13.6 billion during 1976.

Other Federal R&D support is expected to total $6.5 billion in 1976, or 17 percent of all R&D spending. The largest shares of this total will go to the fields of health, energy, and environment.

Non-Federal funding of R&D activities is expected to remain at 47 percent of the total in 1976. The non-Federal share has been approximately at this level since 1974.





Research and Development/Gross National Product

The growth in total funds for research and development over the past 11 years has not kept pace with the growth in the GNP. This trend is likely to continue into 1976 when R&D expenditures are expected to amount to 2.2 percent of the GNP, down from 2.3 percent in 1975 and the high of 3.0 percent in 1964. While non-Federal R&D spending has remained nearly constant at 1.1 percent of the GNP, Federal R&D spending is expected to drop from 2.0 percent of the GNP in 1964 to 1.2 percent in 1976.

Transfers of Funds

The following transfer tables present estimated 1976 data in matrix form which provides a statistical framework to permit comparisons of the various sectors of the economy of funds used for research and development as well as basic research, applied research, and development in the United States.

Federal agencies are expected to contribute 53 percent of all R&D funds in 1976, over one-half of which will be performed by industry. Although the rate of growth of Federal R&D support has been leveling off in recent years, this sector continues to be the largest source of R&D funding. Between 1967 and 1975, however, its share of the national R&D effort dropped from 62 percent to 53 percent and is expected to remain at 53 percent in 1976.

The industry sector, second in size in support of R&D activities, is expected to show an 8-percent increase in funding between 1975 and 1976. In contrast to the wide distribution given Federal monies, intramural research and development in the industry sector will account for 99 percent or $16.3 billion of the $16.5 billion allocated by private enterprise to R&D activities.

The largest performers of basic research continue to be the universities and colleges, which, along with their associated Federally Funded Research and Development Centers (FFRDC's), will spend an estimated $2.9 billion for these activities in 1976.[2] This sector accounts for over 60 percent of all basic research performance.

In 1976 the industrial sector is expected to perform $4.8 billion in applied research and $20.9 billion in development. This will amount to 54 percent and 86 percent of the total, respectively, making the industrial sector the largest performer of both areas. As a source of funds, industry will provide $3.6 billion of the $8.9 billion allocated to applied research, or 41 percent, and $12.2 billion of the $24.4 billion allocated to development, or 50 percent.

[2] Excludes departmental research, which is considered an integral part of instructional programs, and for which separate data are frequently not maintained. This represents a change from previously reported data. See technical notes section in "Revision of R&D Time Series Since February 1974," National Science Foundation, *National Patterns of R&D Resources: Funds & Manpower in the United States, 1953-75* (NSF 75-307) (Washington, D.C. 20402: Supt. of Documents, U.S. Government Printing Office, 1975).

Table 1. Intersectoral transfers of funds used for performance of research and development, basic research, applied research, and development: 1976 (estimated)

RESEARCH AND DEVELOPMENT[1]
[Dollars in millions]

Sources of funds	Performers					Total	Percent distribution, sources
	Federal Government	Industry[2]	Universities and colleges[3]	Associated FFRDC's[4]	Other nonprofit institutions[2]		
Federal Government	5,600	10,200	2,450	1,080	800	20,130	52.8
Industry	—	16,300	120	—	130	16,550	43.5
Universities and colleges	—	—	[5]815	—	—	815	2.1
Other nonprofit institutions	—	—	275	—	[5]320	595	1.6
Total	5,600	26,500	3,660	1,080	1,250	38,090	
			4,740				
Percent distribution, performers	14.7	69.6	9.6	2.8	3.3		100.0
			12.4				

BASIC RESEARCH[1]
[Dollars in millions]

Sources of funds	Performers					Total	Percent distribution, sources
	Federal Government	Industry[2]	Universities and colleges[3]	Associated FFRDC's[4]	Other nonprofit institutions[2]		
Federal Government	750	170	1,825	335	130	3,210	67.6
Industry	—	605	75	—	35	715	15.0
Universities and colleges	—	—	[5]525	—	—	525	11.1
Other nonprofit institutions	—	—	175	—	[5]125	300	6.3
Total	750	775	2,600	335	290	4,750	
			2,935				
Percent distribution, performers	15.8	16.3	54.7	7.1	6.1		100.0
			61.8				

[1] All data estimated from reports by performers.

[2] Expenditures for Federally Funded Research and Development Centers (FFRDC's) administered by both industry and by nonprofit institutions are included in the totals of their respective sectors. FFRDC's are organizations exclusively or substantially financed by the Federal Government to meet a particular requirement or to provide major facilities for research and training purposes.

[3] Includes agricultural experiment stations; excludes departmental research.

Table 1. Intersectoral transfers of funds used for performance of research and development, basic research, applied research, and development: 1976 (estimated)—Con.

APPLIED RESEARCH[1]
[Dollars in millions]

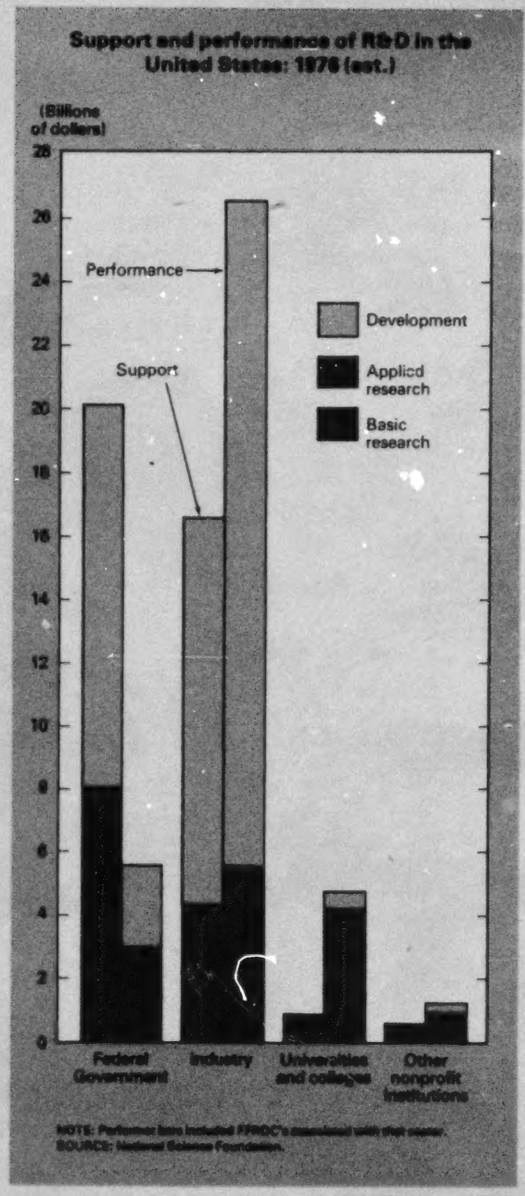
Sources of funds	Performers: Federal Government	Industry[2]	Universities and colleges[3]	Associated FFRDC's[4]	Other nonprofit institutions[2]	Total	Percent distribution, sources
Federal Government	2,250	1,250	545	380	400	4,825	54.1
Industry	—	3,550	35	—	60	3,645	40.8
Universities and colleges	—	—	[5]250	—	—	250	2.8
Other nonprofit institutions	—	—	85	—	[5]120	205	2.3
Total	2,250	4,800	915	380	580	8,925	
			1,295				
Percent distribution, performers	25.2	53.8	10.2	4.3	6.5		100.0
			14.5				

DEVELOPMENT[1]
[Dollars in millions]

Sources of funds	Performers: Federal Government	Industry[2]	Universities and colleges[3]	Associated FFRDC's[4]	Other nonprofit institutions[2]	Total	Percent distribution, sources
Federal Government	2,600	8,780	80	365	270	12,095	49.5
Industry	—	12,145	10	—	35	12,190	49.9
Universities and colleges	—	—	40	—	—	40	0.2
Other nonprofit institutions	—	—	15	—	75	90	0.4
Total	2,600	20,925	145	365	380	24,415	
			510				
Percent distribution, performers	10.6	85.7	0.6	1.5	1.6		100.0
			2.1				

[4] Federally Funded Research and Development Centers (FFRDC's) administered by individual universities and colleges and by university consortia.
[5] Includes State and local government funds for performance of research and development in these sectors.

NOTE: Because of limited survey data, intramural R&D expenditures of State and local governments have not been included in this report. In 1973, this amounted to an estimated $225 million.
SOURCE: National Science Foundation.



Character of R&D Work

BASIC RESEARCH

Total funds for basic research are expected to reach $4.8 billion in 1976, rising by 7 percent from the 1975 level. In constant dollars, this represents a 1-percent increase between the two years. Total spending for basic research, in terms of constant dollars, has declined at an average annual rate of 0.9 percent since 1967.

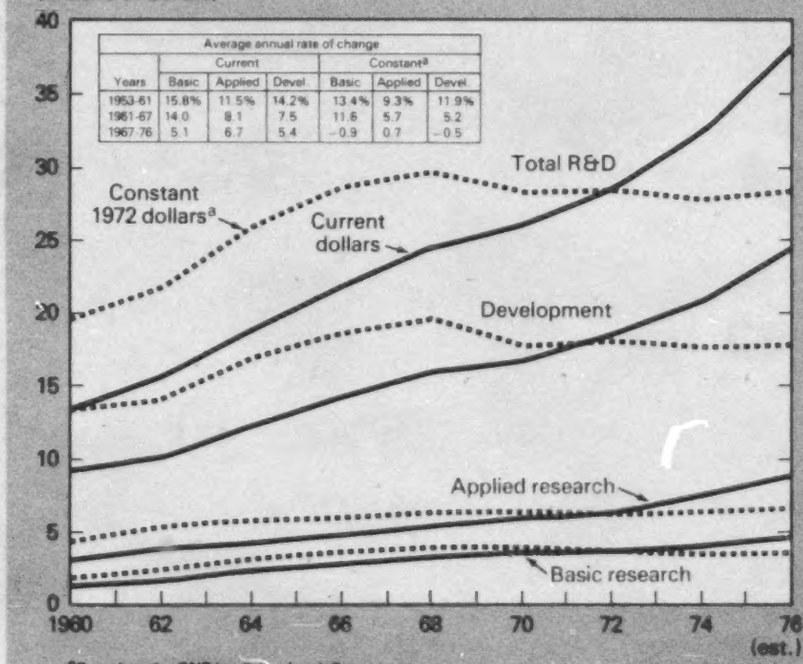
Federal Government support of basic research is expected to rise by 6 percent between 1975 and 1976 to $3.2 billion, accounting for 68 percent of total funds for basic research. In 1967 the Federal Government funded 72 percent of all basic research.

Non-Federal support of basic research is expected to reach $1.5 billion in 1976, an increase of 9 percent over 1975.

Universities and colleges are the major performers of the Nation's basic research, devoting 71 percent of their R&D outlays to this activity. In 1976 this sector is expected to perform 55 percent of the total basic research effort, and their associated FFRDC's are estimated to represent another 7 percent. The Federal Government and industry are each expected to account for about 16 percent of basic research performance, and other nonprofit institutions the remaining 6 percent.

National R&D totals by character of work: 1960-76

(Billions of dollars)



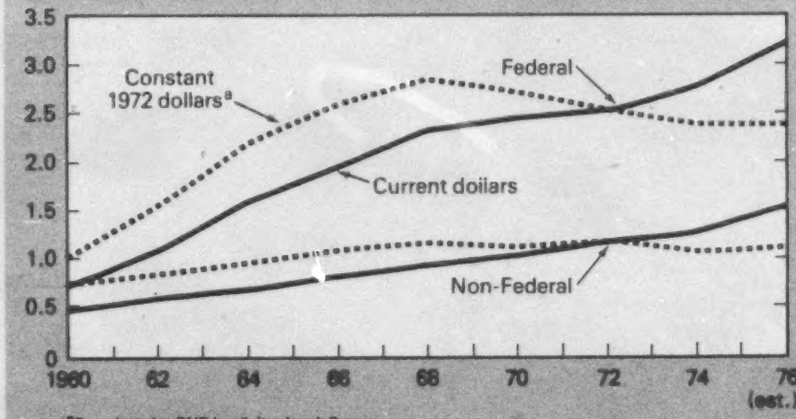
Average annual rate of change

Years	Current			Constant[a]		
	Basic	Applied	Devel.	Basic	Applied	Devel.
1953-61	15.8%	11.5%	14.2%	13.4%	9.3%	11.9%
1961-67	14.0	8.1	7.5	11.6	5.7	5.2
1967-76	5.1	6.7	5.4	−0.9	0.7	−0.5

[a]Based on the GNP implicit price deflator.
SOURCE: National Science Foundation.

Federal and non-Federal financing of basic research: 1960-76

(Billions of dollars)



[a]Based on the GNP implicit price deflator.
SOURCE: National Science Foundation.

APPLIED RESEARCH

An estimated $8.9 billion will be spent on applied research in 1976, 8 percent above the 1975 level. In terms of constant dollars, only applied research funds are expected to be greater in 1976 than they were in 1967; funds for basic research and development have declined.

The Federal Government, with $4.8 billion, and industry, with $3.6 billion, will finance 95 percent of the total applied research effort in 1976. The remainder will be supported by universities and colleges, $250 million, and other nonprofit institutions, $205 million.

Industry, the leading performer of applied research, is expected to spend $4.8 billion in this field in 1976, or 54 percent of the total. Over one-half of the industrial applied research effort will be carried out by three industries: chemicals, electrical equipment and communication, and aircraft and missiles.

Of the total funds for applied research, 25 percent is expected to be utilized by the Federal Government. Three agencies, the Department of Defense (DOD), the National Aeronautics and Space Administration (NASA), and the Department of Health, Education, and Welfare (HEW) will account for three-quarters of Federal intramural expenditures for applied research.

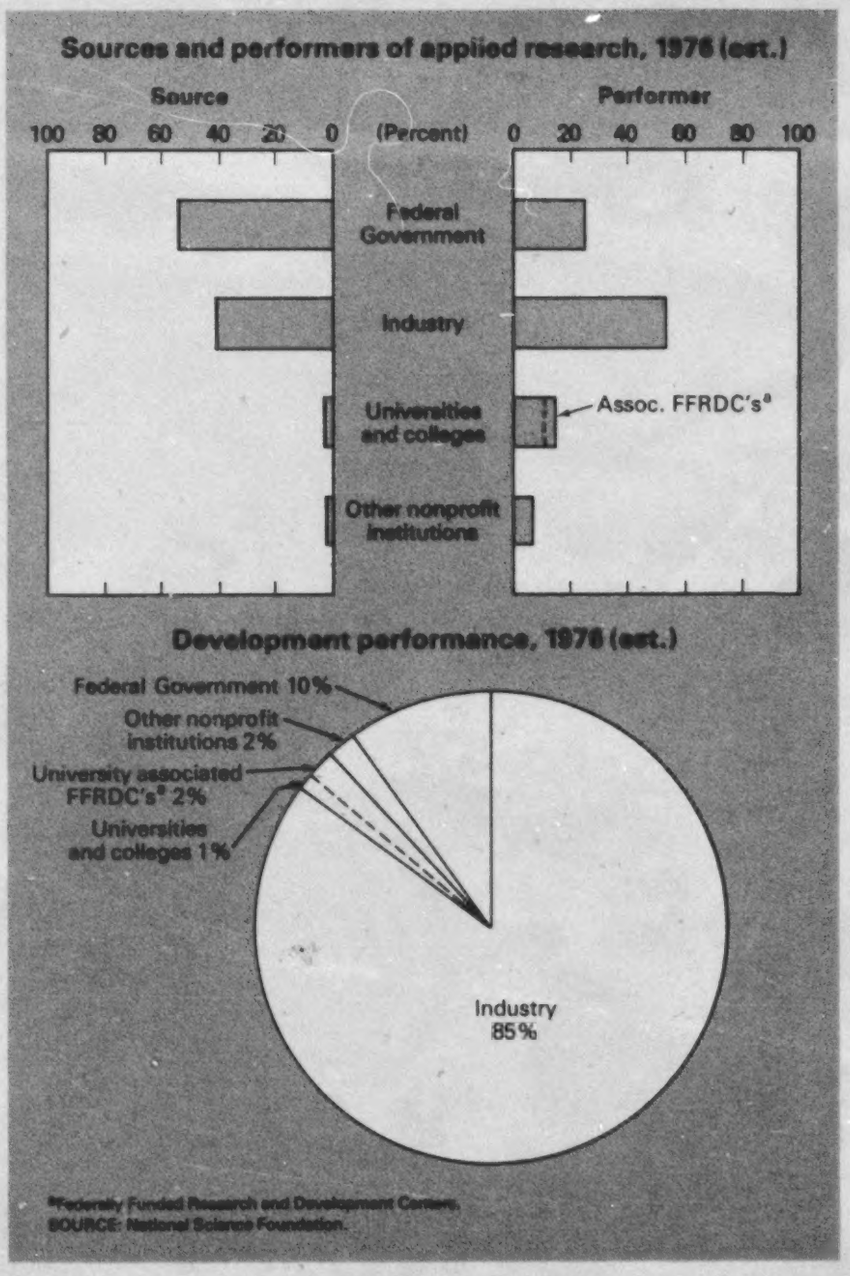
DEVELOPMENT

In 1976 an estimated $24.4 billion will be spent on development activities, 9 percent more than in the previous year. Expenditures for development historically account for nearly two-thirds of total national R&D spending

The Federal Government and industry will finance, in nearly equal shares, 99 percent of development in 1976. In the sixties the Federal Government supported the major portion, but industry financing has since grown at a faster rate.

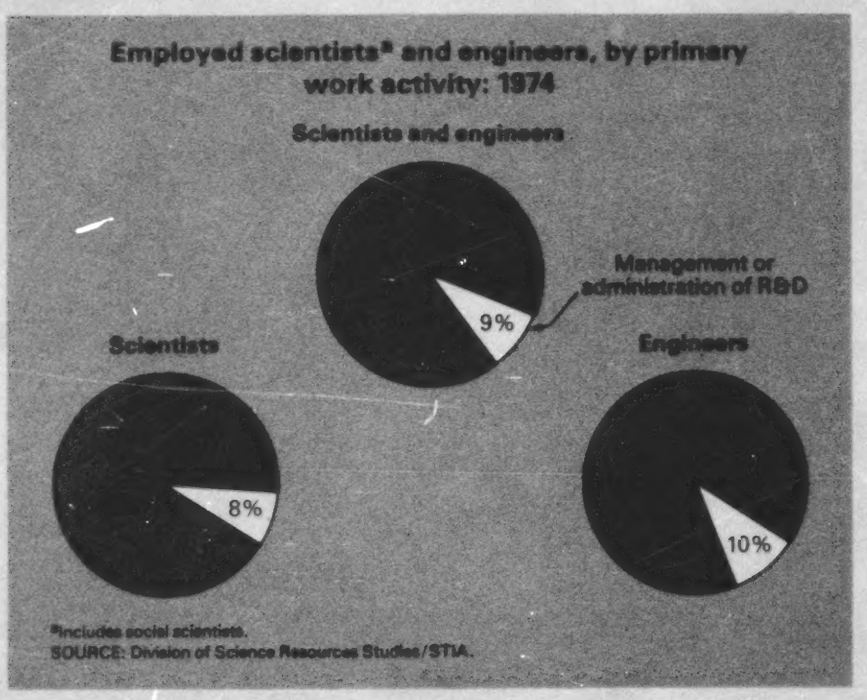
Industry will continue to be the dominant performer of development in 1976, spending nearly $21 billion, or 86 percent of the total. Development expenditures will represent over three-quarters of industry's total R&D outlays for the year. Two industries, aircraft and missiles and electrical equipment and communication, are expected to account for over one-half of industry's development expenditures.

The Federal Government is expected to utilize $2.6 billion, or 11 percent, of the total funds for development in 1976. Nearly 90 percent of intramural Federal spending for development will be accounted for by DOD and NASA.



R&D MANPOWER

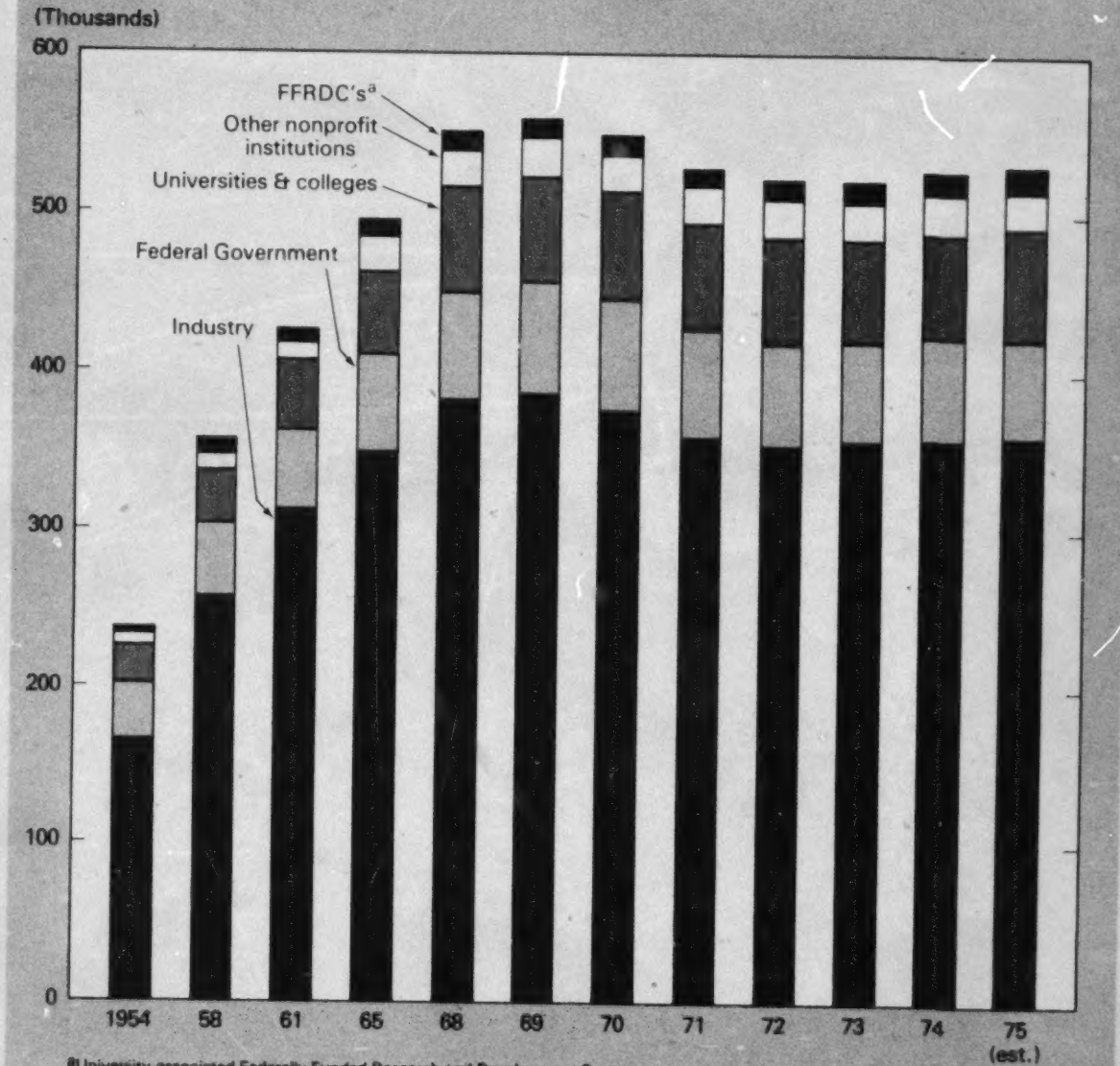
In 1975 about 530,000 scientists and engineers were engaged in R&D activities on a full-time-equivalent (FTE) basis in all sectors of the economy (excluding State and local governments). The number continues to account for about one-third of the estimated total employment of scientists and engineers. Of the scientists, about one-fourth were performing research and development and another 8 percent were managing or administering research and development. Of the engineers, 34 percent were in research and development and 10 percent were managers or administrators. The accompanying charts and appendix table B-10 present information on the distribution of these workers among the economic sectors. It should be noted that the data in the table represent yearly averages for the industry sector only, whereas the figures shown for each sector in the remainder of this section are based on employment surveys for a single month of the year.



Between 1954 and 1969 the employment of R&D-performing scientists and engineers grew by 321,000, an average annual rate of 5.9 percent and 1.8 times the rate for all workers. Between 1969 and 1973, however, 37,000 of these jobs were lost, at an average annual rate of 2.3 percent, while total employment increased at a rate of 2 percent per year. In the 1973-75 period the employment level of R&D scientists and engineers increased by 9,400, recovering a fourth of the jobs lost in the previous four years.

Since 1954 the share of R&D scientists and engineers employed by each major sector has shown only slight changes. The decline in the proportion employed by the industry sector after the early sixties—from about 73 percent to 68 percent by 1975—was accompanied by an increase in the university sector from 10 percent to 13 percent. The Federal Government share has remained between 12 percent and 13 percent and the university and college-associated FFRDC's at 2 percent since the early sixties, while the nonprofit institution sector rose from a 2.6 percent share in 1961 to more than 4 percent in the late sixties, and has remained constant subsequently. The nonprofit sector's relative growth, the largest of any major sector, is a result of increased Federal funding of social science and health-related research which many of these institutions perform.

Full-time-equivalent scientists and engineers employed in R&D, by sector: selected years

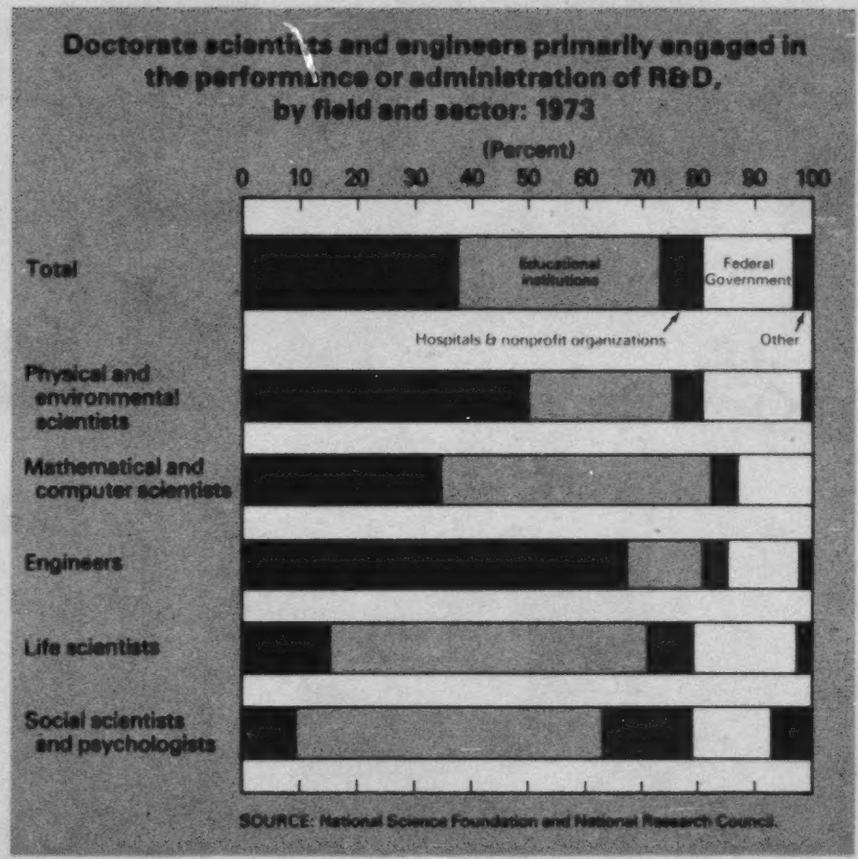


[a]University-associated Federally Funded Research and Development Centers.
SOURCE: National Science Foundation.

The 106,000 scientists and engineers with doctorates engaged in research and development or its management represented about one-fifth of all R&D scientists and engineers in 1973. Nearly 40 percent of these doctorates were employed by business firms, another 36 percent by universities, and the remainder by the Federal Government (16 percent) and other organizations. The two largest groups were the physical and environmental scientists with 35,000 members, followed by life scientists (32,000).

About 77,000 of these doctorates were performing basic research (36,000), applied research (31,000), or development (10,000). Another 29,000 were in R&D management either exclusively, or in addition to other activities. The basic researchers were dominated by physical, environmental, and life scientists, most of whom were in universities. Physical, environmental and life scientists, and engineers, represented the large majority of the applied researchers, and industry was their largest single employer. Engineers in industry accounted for more than one-half the doctorates engaged in development.

Of the doctorates who performed management functions, engineers and physical and environmental scientists in industry represented the largest groups, totaling more than one-third of all the managers.



Industry

Between 1973 and 1975 the FTE employment of scientists and engineers by the industrial sector of the economy has changed little, remaining at about the 1975 level of 357,000. This is slightly more than the low point of the past decade of 350,000 in 1972 (table 2). No single industry or group of industries registered significant employment changes between the Januarys of 1974 and 1975. The two largest industry groups—electrical equipment manufacturers and communications, and aircraft, missile and ordnance manufacturers—accounted for about 46 percent of the R&D scientists and engineers, while representing about 6 percent of all workers in this sector.

The changes of R&D scientist and engineer employment since 1970, when it was near its all-time high, show that in the 5-year period total employment decreased by about 27,000, a 7-percent loss, but the two above-mentioned industry groups sustained a loss of 36,000, or 18 percent. The industries which had the major increases of employment which partially offset these losses were transportation equipment (excluding aircraft), machinery, and chemicals manufacturers.

Table 2. Full-time-equivalent number of R&D scientists and engineers, by industry: January 1957-75[1]

[In thousands]

Industry	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Total	229.4	243.8	268.4	292.0	312.1	312.0	327.3	340.2	343.6	353.2	367.2	378.7	387.1	384.1	368.8	349.9	358.8	368.2	357.5
Chemicals and allied products	29.4	31.0	33.5	36.1	37.0	36.5	38.3	35.3	37.9	38.6	36.9	38.9	40.3	40.2	42.8	40.9	40.7	41.8	43.4
Petroleum refining and extraction	6.9	7.4	7.7	9.2	9.0	9.1	8.9	8.1	8.7	8.9	8.7	9.2	10.0	9.9	9.2	8.3	8.2	8.2	8.4
Rubber products	4.7	4.7	4.8	5.3	5.5	5.6	5.8	6.0	5.8	5.7	5.8	6.1	6.3	6.8	5.9	5.8	5.8	5.7	5.9
Stone, clay, and glass products	[2]	[2]	[2]	[2]	3.8	3.7	3.8	3.3	3.5	3.1	3.3	4.1	4.2	4.6	4.1	3.9	3.9	4.1	4.3
Primary metals	5.1	5.2	5.7	6.9	6.9	6.0	5.2	5.1	5.5	5.5	5.9	5.9	6.2	6.3	6.3	6.0	5.5	5.7	5.9
Fabricated metal products	8.4	8.3	8.9	7.4	8.6	7.4	6.8	7.0	6.6	6.3	6.3	5.6	6.6	5.9	6.9	6.4	6.5	6.9	7.1
Machinery	24.9	27.4	29.4	32.1	33.0	31.5	31.4	27.3	29.4	30.5	33.6	37.4	39.4	41.4	40.5	41.1	41.7	43.2	44.9
Electrical equipment and communication	42.9	47.9	54.8	72.1	79.2	82.3	85.8	89.5	87.6	92.0	96.6	98.4	101.6	102.4	95.2	87.7	92.8	93.6	91.4
Motor vehicles and other transportation equipment	13.6	15.0	16.8	17.8	19.1	20.8	21.1	23.3	24.1	24.8	25.2	24.3	25.0	25.1	27.8	29.3	29.2	28.4	27.0
Aircraft and missiles	58.7	58.6	65.9	72.4	78.5	79.4	90.7	101.1	99.2	99.3	100.4	101.1	99.9	92.6	78.3	71.2	72.3	70.8	66.8
Professional and scientific instruments	10.2	11.0	12.0	10.0	11.1	9.8	9.4	10.8	11.5	12.5	13.0	14.1	15.1	14.8	15.1	15.1	15.9	16.6	16.9
Other manufacturing industries					12.9	11.7	11.9	13.6	14.0	14.3	15.4	16.5	17.4	17.8	19.1	18.5	25.5	19.0	20.3
Other nonmanufacturing industries	[3]24.6	[3]27.3	[3]28.9	[3]22.6	7.5	7.0	8.2	9.8	9.6	11.7	14.1	15.1	15.1	16.3	15.6	15.7	15.3	14.4	15.2

[1] Excludes social scientists.

[2] Data included in the "other manufacturing" group.

[3] For years 1957-60, other manufacturing and nonmanufacturing combined. Other manufacturing industries include food and kindred products; textiles; apparel; lumber and wood products; paper and allied products; tobacco products; printing and publishing; leather products and miscellaneous manufacturing.

Source: National Science Foundation.

Table 3 compares the 1970-75 changes in R&D scientist and engineer employment with total employment in the same industries shown in table 2. While total employment rose by 6 percent in this 5-year period and R&D employment decreased by 7 percent, there are wide variations by industry. For example, the total employment by automobile manufacturers decreased by 12 percent in this period, while their R&D scientists and engineers increased by 8 percent. In the petroleum industry, total employment increased by almost one-half while R&D scientists and engineers fell by 15 percent.

Table 3.—Changes in total employment and FTE[1] R&D scientist and engineer employment, by industry: 1970-75

Industry	1970-75 percent changes	
	Total employment	FTE R&D scientists and engineers
Total	6.2	-6.9
Chemicals and allied products	-2.4	8.0
Petroleum refining and extraction	48.5	-15.2
Rubber products	2.7	-13.2
Stone, clay, and glass products	-3.2	-6.5
Primary metals	-6.6	-6.3
Fabricated metal products	-5.9	20.3
Machinery	5.3	8.5
Electrical equipment and communication	-0.4	-10.7
Motor vehicles and other transportation equipment	-12.0	7.6
Aircraft and missiles	-29.9	-27.9
Professional and scientific instruments	8.7	14.2
Other manufacturing industries	-8.3	14.0
Other nonmanufacturing industries	12.6	-6.7

[1] Full-time equivalent.
Sources: U.S. Bureau of Labor Statistics, National Science Foundation.

Universities and Colleges

The highest employment level yet recorded for the employment of scientists and engineers primarily engaged in research and development in colleges and universities was reached in early 1975, when 49,300 were counted; this figure surpassed the 1971 high by about 1,000. Three of the five major occupational groups contributed to this gain, although individually none surpassed its own previous record level. The gaining groups—engineering and the life and social sciences—increased more than the small declines in the physical sciences and mathematics. The fastest growing field in the past decade is the "other physical scientists," chief among which are environmental scientists. This group nearly doubled between 1965 and 1975, whereas all other fields combined grew by one-fifth in the same period. Table 4 depicts the number of scientists and engineers primarily engaged in research and development from 1965 to 1975. (These data exclude those scientists and engineers employed by university-administered FFRDC's.)

Table 4. Number of scientists and engineers primarily engaged in research and development in universities and colleges, by field of specialization: for January of selected years[1]

Field of specialization	1965	1969	1971	1973	1974	1975
All fields	40,003	47,118	48,268	46,481	48,091	49,333
Engineering	4,153	4,976	4,839	4,998	4,767	4,810
Physical and environmental sciences	5,927	6,970	7,314	7,896	8,244	8,135
Chemistry	2,335	2,685	2,579	2,781	3,084	2,893
Physics	2,132	2,394	2,411	2,474	2,497	2,432
Other	1,460	1,891	2,324	2,641	2,663	2,810
Mathematics	932	1,669	1,446	1,310	1,543	1,537
Life sciences	24,955	28,307	30,433	27,867	28,870	29,863
Social sciences and psychology[2]	4,036	5,196	4,236	4,410	4,667	4,988

[1] Excludes graduate students.
[2] Social sciences excludes history.
Source: National Science Foundation.

A new high in the employment of graduate science and engineering (S/E) students by universities and colleges in research and development was also recorded in 1975, with nearly 39,000 employed, 1,600 more than the previous high level of 1971. Record levels were set in engineering, the life and social sciences in 1975, while physical sciences and mathematics maintained their 1974 levels, both lower than the peaks they reached in 1969. Social sciences was the fastest growing field during the 1965-75 decade, nearly doubling its graduate student R&D employment, while all the other fields combined grew by 35 percent in the same period (table 5).

In the 21 FFRDC's administered by universities, 12,400 scientists and engineers were primarily employed in R&D activities in 1975, more than recorded in any previous year. Engineers and physicists comprise 70 percent of the S/E employment in these institutions, continuing to be the two dominant groups since the midsixties (table 6). These centers employed about 700 S/E graduate students, 86 percent of whom were in the physical sciences or engineering, and nearly 7,100 technicians, 85 percent of whom were in the engineering and physical science fields.

Federal Government

The Federal Government employed an estimated 47,300 civilian R&D scientists and engineers in 1974. As it has done in past years, DOD employed about one-half of these workers while NASA, the Departments of Agriculture, Interior, and Health, Education, and Welfare were the other major employers.

Table 5. Number of graduate students engaged part-time in research and development, by field of specialization: for January of selected years

Field of specialization	1965	1969	1971	1973	1974	1975
Total	27,200	35,800	37,200	34,600	36,900	38,800
Engineering	6,400	7,900	8,900	8,400	9,400	9,600
Physical and environmental sciences	8,100	10,600	10,500	8,800	9,200	9,200
Mathematics	900	1,600	1,500	1,500	1,500	1,500
Life sciences	5,500	10,000	11,200	10,500	10,700	12,000
Social sciences and psychology[1]	3,300	5,700	5,100	5,400	6,200	6,500

[1] Social sciences exclude history.
Source: National Science Foundation.

Table 6. Number of scientists and engineers primarily engaged in research and development in Federally Funded Research and Development Centers,[1] by field of specialization: for January of selected years

Field of specialization	1965	1969	1971	1973	1974	1975
Total	11,113	11,263	11,118	12,169	11,905	12,445
Engineering	4,914	4,960	5,034	5,631	5,675	5,785
Physical and environmental sciences	4,563	4,294	4,225	4,434	4,585	4,788
Chemistry	1,409	1,221	1,175	1,189	1,133	1,267
Physics	2,454	2,634	2,589	2,737	2,797	2,930
Other	700	439	461	508	655	591
Mathematics	940	1,085	1,083	1,149	1,010	1,236
Life sciences	656	414	376	527	468	496
Social sciences and psychology[2]	187	510	400	428	167	140

[1] Administered by universities and colleges.
[2] Social sciences exclude history.
Source: National Science Foundation.

Other

The latest detailed information about the R&D-related employment in nonprofit organizations and State governments is available for 1973. In that year, 444 nonprofit organizations employed 23,100 scientists and engineers who were engaged in R&D activities, the highest level recorded since the survey of these organizations was initiated in 1965. It is estimated that in 1975 this employment has remained about the same. A distribution by field of specialization for 1975, however, is not available. Table 7 provides data on employment by broad field of specialization in R&D activities of nonprofit organizations.

State governments employed the full-time equivalent of 4,900 R&D scientists and engineers in the 1973 fiscal year, 31 percent more than in 1968. Two-fifths of these workers were engaged in research and development related to natural resources—agriculture, environmental protection, and energy development and conservation—the only major function increasing considerably faster than the average during the 5-year period (table 8). In addition to the 4,900 scientists and engineers, the States employed 3,300 technicians in R&D activities.

R&D performance in State governments is highly concentrated. The two most populous States—New York and California, with 19 percent of all the U.S. population—employed one-third of all State government R&D scientists and engineers. The five States employing the largest numbers of R&D workers (adding Florida, Illinois, and Virginia) accounted for more than one-half of all R&D scientists and engineers employed by States. In total, 30 percent of the Nation's population resided in these five States in 1973.

Table 7. Number of scientists and engineers primarily engaged in research and development in nonprofit institutions, by field of specialization: for selected years

Field of specialization	1965[1]	1967[1]	1970[1]	1973[2]
All fields	18,795	22,495	21,806	23,129
Engineering	3,805	4,818	4,801	5,087
Physical and environmental sciences	3,039	3,630	3,409	3,196
Mathematics	2,098	2,208	1,382	1,439
Life sciences	6,705	7,460	7,358	8,981
Social sciences and psychology[3]	3,148	4,379	4,856	4,426

[1] January.
[2] October.
[3] Social sciences includes economics and sociology.
Source: National Science Foundation.

Table 8. Full-time-equivalent number of R&D scientists and engineers in State governments, by function: fiscal years 1968, 1972, and 1973

Function	1968	1972	1973	Percent change 1968-73
Total	3,733	4,610	4,899	31.2
Health and hospitals	1,377	1,702	1,812	31.6
Natural resources[1]	1,325	1,858	2,007	51.5
Education	369	235	206	44.2
Crime prevention	85	69	104	22.4
Transportation and communications	387	454	477	23.3
All other	190	292	293	54.2

[1] Includes environment, energy development and conservation, and agriculture.
Source: National Science Foundation.

APPENDIXES

A. Basis for Sectoring and Technical Notes

B. Statistical Tables

APPENDIX A

Basis for Sectoring

The National Science Foundation follows a four-sector division in surveying R&D funds and personnel and maintaining the time series for expenditures and employment. This division is based on an approach that attempts to take account of both the legal nature and major functions of organizations active in financing and performing basic research, applied research, and development. Grouping diverse types of organizations into discrete sectors, however, requires certain arbitrary judgments because of the mixed nature of many organizations, particularly those in the university and other nonprofit sectors.

The *Federal sector* is made up of the agencies of the Federal Government. The *industry sector* consists of both manufacturing and nonmanufacturing companies. Manufacturing is classified in major industry groupings; and nonmanufacturing, which includes organizations such as those in selected service industries, is treated as a unit. Federally Funded Research and Development Centers (FFRDC's) administered by industrial firms are also included.

The *universities and colleges sector* is composed of all institutions of higher education, both public and private. The term "universities and colleges" is used in this report to refer to the academic institutions as a group without the associated FFRDC's administered by the schools for various Federal agencies. The universities and colleges comprise the following:

Colleges of liberal arts; schools of arts and sciences; professional schools, such as engineering and medical schools, including affiliated hospitals; associated research institutions, and similar organizations, which are integral parts of the universities and colleges; agricultural experiment stations, and associated schools of agriculture.

Funds used at the universities and attributed to the universities sector as a source consist of several components: (1) State and local government funds separately budgeted for research and development, and (2) unrestricted or general funds which the institutions themselves have been free to allocate for research. Funds from the Federal Government, industry, or other nonprofit institutions, which are supplied in the form of grants or contracts for research or development at a university, are credited to the appropriate source in the performance of research and development by universities and colleges. Thus, research contracts from industry are treated as university performance funded by industry as the source, whereas funds given to the institution by industry for general educational purposes and used by the school, at its discretion, for research, are treated as university performance financed with the university's own funds.

Institutions in the *other nonprofit sector* fall into two general groups: (1) organizations that are primarily granting in nature, namely private philanthropic foundations and voluntary health agencies, and (2) public and private organizations that are involved in performing research and development, comprising separately incorporated nonprofit research institutes, professional societies, academies of science, museums, zoological gardens, botanical gardens, arboretums, nonprofit hospitals, and FFRDC's administered by nonprofit organizations.

In this report, both the university and the other nonprofit sectors contain private and public institutions—the latter are closely associated with State or local governments. A number of organizations in both sectors, as well as in industry, also receive State and local government funds.

Technical Notes

CONCEPTS AND DEFINITIONS

Research and development in this report consists of basic and applied research in the sciences (including medical sciences) and in engineering and activities in development, all defined below. In terms of fields, the natural sciences—life, physical, and engineering—as well as the social and psychological sciences are covered in the Federal, universities, and other nonprofit sectors. Industry coverage is limited, at present, to the natural sciences.

Research, which encompasses both basic and applied, is systematic, intensive study directed toward fuller scientific knowledge of the subject studied.

Basic research. For three of the sectors—Federal Government, universities and colleges, and other nonprofit institutions—the definition of basic research stresses that it is directed toward increases of knowledge in science with ". . .a fuller knowledge or understanding of the subject under study, rather than a practical application thereof." To take account of an individual industrial company's commercial goals, the definition for the industry sector is modified to indicate that basic research projects represent ". . .original investigations for the advancement of scientific knowledge. . .which do not have specific commercial objectives, although they may be in fields of present or potential interest to the reporting company."

Applied research. The following is the core definition in the NSF questionnaire sent to the universities and colleges: "Applied research is directed toward practical application of knowledge." Here again, the definition for the industry survey takes account of the characteristics of industrial organizations it covers ". . .research projects which represent investigations directed to discovery of new scientific knowledge and which have specific commercial objectives with respect to either products or processes." By this definition, applied research in industry differs from basic research chiefly in terms of objectives of the reporting company.

Development. The NSF survey concept of development may be summarized as ". . .the systematic use of scientific knowledge directed toward the production of useful materials, devices, systems or methods, including design and development of prototypes and processes."

FUNDS

Current operating costs

Funds used for research and development, reported in this study, refer to current operating costs, consisting of both direct and indirect costs including depreciation, insofar as this information is available to respondents. Capital expenditures are excluded by definition and this is followed by the industry, universities and colleges, and other nonprofit sectors. Under the accounting practices of some Federal agencies—particularly the Department of Defense—data on Federal R&D funds, which are available in detail only in terms of obligations rather than expenditures, do not include an allowance for depreciation but do include some obligations for capital items.

Performer-reporting basis

In the Foundation's surveys, respondents in all four sectors indicate the amounts they spend on research and development in their own sector and the sources of these funds. The National Science Foundation bases all national totals on data as reported by performers because institutions doing research and development are in the best position to: (a) indicate how much they spent in the actual conduct of research and development in a given year, (b) classify their work as basic, applied, etc., and (c) identify the sector of the economy in which their financing originated. The use of performer reporting throughout also reduces the possibility of double counting. Because the national time series on Federal funds spent in research and development are based on expenditures reported by organizations which have actually performed the research and development, they differ from the series in the *Federal Funds for Research, Development, and Other Scientific Activities* on agency obligations for research and development to be performed in the non-Federal sectors. Federal agency obligations are used in the series only for intramural performance in agency laboratories where they are treated as the equivalent of expenditures. Expenses of Federal personnel engaged in planning and administering intramural and extramural R&D programs are also included in the intramural performance total.

There have been surveys in all four sectors thus far in the NSF time series for the following years: 1953-54, 1957-58, 1964, 1966, and 1973. In general, the Federal Government and industry have been surveyed every year, but it has not been possible to maintain the same frequency for the universities and other nonprofit institutions. National data for other years are based on survey data on the performance of total research and development, basic research, applied research, and development from the Federal and industry sectors and on estimates for the university and other nonprofit sectors.

Single-year designation for national totals

Data for calendar year 1953 for industry and nonprofit institutions are combined with Federal intramural and university data for fiscal year 1953 (that is, July 1952 through June 1953) in the R&D funds series. The sector data for the years following 1953 are grouped accordingly and the annual national totals are based on this phasing.

Defense-space classification

Defense expenditures consist of all R&D spending by DOD and a proportion of Energy Research and Development Administration (ERDA) funds (formerly AEC). Space R&D expenditures are those of NASA. The space activities of DOD are included as spending on defense. The space activities of other Federal agencies are not included; it is estimated they account for less than 5 percent of all space R&D spending. This series has been revised to include R&D performance reporting where available.

Revisions of R&D time series since February 1975

Federal Government. Data were revised based on the NSF annual survey of R&D activities by Federal agencies covering fiscal years 1974, 1975, and 1976, and the 1977 Federal Budget, Special Analysis P.

Industry. Data were revised for 1973 on the basis of the annual "shuttle" questionnaire that enables respondents to revise the figure reported for the preceding year when they report on the current year. Data for 1974 were obtained from the 1974 industrial R&D survey.

Universities and colleges. Data for 1972-74 were revised based on information obtained in the 1974 survey. Data for institutions' own funds were revised back to 1953 to exclude departmental research, which is considered to be an integral part of the instructional programs, and, for which, separate data are frequently not maintained.

Other nonprofit institutions. Data for 1964-74 were based on the 1964, 1966, 1969, and 1973 surveys and on detailed information from the National Institutes of Health on voluntary nonprofit hospitals for years prior to 1969.

Data for 1974 are classified as preliminary because a final report on intramural performance of research and development was available only for the Federal and the universities and colleges sectors. In addition, preliminary data from the 1974 industrial R&D survey were available. Estimates for 1975 and 1976 are extensions of the regular time series, taking into account trends shown in *Federal Funds for Research, Development, and Other Scientific Activities, Fiscal Years 1974, 1975, and 1976*, Vol. XXIV[1] as well as other related information.

[1] National Science Foundation, *Federal Funds for Research, Development, and Other Scientific Activities, Fiscal Years 1974, 1975, and 1976*, Vol. XXIV (NSF 75-334) (Washington, D.C. 20402, Supt. of Documents, U.S. Government Printing Office, 1976).

MANPOWER

Full-time-equivalent (FTE) number of scientists and engineers

The concept of the FTE provides a common denominator for combining the number of full-time employees with an FTE number of part-time employees to achieve a quantitative measure of manpower input. The minimum standard for inclusion of scientists and engineers was the performance of professional scientific or engineering work in research and development, requiring a bachelor's degree, or its equivalent, in science or engineering. In the industry, university, and other nonprofit sectors, both the manpower and expenditures data for each year were obtained in the same surveys; in the Federal sector, data on expenditures and civilian scientists and engineers were reported in different inquiries, and estimates of military scientists and engineers were obtained separately.

Revisions of R&D time series since February 1975

Data for 1974 were based on surveys of Federal Government personnel as of October 1974, industry as of January 1974 and January 1975, other nonprofit organizations as of October 1973, and universities and colleges as of January 1974 and January 1975 and other related sources. Data for 1975 are estimated except for the universities and colleges sector. Survey results as of January 1975 for this sector are included.

APPENDIX B
Statistical Tables

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Table B–1. Transfers of funds expended annually for performance of research and development by sector, distributed by source, 1953–76[1]

[Dollars in millions]

Year	Total R&D	Federal Government		Industry[2]			Universities and colleges					Associated FFRDC's[3]		Other nonprofit institutions[2]			
			Source		Sources			Sources					Source		Sources		
		Total funds used	Federal Government	Total funds used	Federal Governments	Industry[4]	Total funds used	Federal Government	Industry	Universities and colleges[4]	Other nonprofit institutions	Total funds used	Federal Government	Total funds used	Federal Government	Industry	Other nonprofit institutions[4]
1953	5,128	1,010	1,010	3,630	1,430	2,200	[5]255	138	19	72	26	121	121	112	60	20	32
1954	5,651	1,020	1,020	4,070	[5]1,750	[5]2,320	290	160	22	80	28	141	141	[5]130	67	25	38
1955	6,182	905	905	4,640	[5]2,180	[5]2,460	[5]312	169	25	88	30	180	180	[5]145	76	28	42
1956	8,375	1,040	1,040	6,605	3,328	3,277	[5]372	213	29	96	34	194	194	[5]164	84	30	50
1957	9,791	1,220	1,220	7,731	4,335	3,396	[5]410	229	34	109	38	240	240	190	95	30	65
1958	10,734	1,374	1,374	8,389	4,759	3,630	456	254	39	121	42	293	293	[5]222	111	31	[illegible]
1959	12,384	1,640	1,640	9,618	5,636	3,983	[5]526	306	39	134	47	338	338	[5]262	140	35	87
1960	13,551	1,726	1,726	10,509	6,081	4,428	[5]646	406	40	149	52	360	360	[5]310	180	40	90
1961	14,346	1,874	1,874	10,908	6,240	4,668	[5]763	500	40	165	58	410	410	[5]391	240	41	110
1962	15,426	2,098	2,098	11,464	6,435	5,029	[5]904	613	40	185	66	470	470	[5]490	310	45	135
1963	17,093	2,279	2,279	12,630	7,270	5,360	[5]1,081	780	41	207	73	530	530	[5]573	390	48	145
1964	18,894	2,838	2,838	13,512	7,720	5,792	1,275	916	41	236	83	629	629	640	450	47	143

Table B–1. Transfers of funds expended annually for performance of research and development by sector, distributed by source, 1953–76[1] – Cont.

[Dollars in millions]

Year	Total R&D	Federal Government		Industry[2]			Universities and colleges					Associated FFRDC's[3]		Other nonprofit institutions[3]			
			Source		Sources			Sources					Source		Sources		
		Total funds used	Federal Government	Total funds used	Federal Government	Industry	Total funds used	Federal Government	Industry	Universities and colleges[4]	Other nonprofit institutions	Total funds used	Federal Government	Total funds used	Federal Government	Industry	Other nonprofit institutions[4]
1965	20,091	3,093	3,093	14,185	7,740	6,445	[5]1,474	1,073	41	267	93	629	629	[5]710	496	53	159
1966	21,894	3,220	3,220	15,548	8,332	7,216	1,715	1,262	42	303	108	630	630	781	546	59	176
1967	23,205	3,396	3,396	16,385	8,365	8,020	[5]1,921	1,409	48	345	119	673	673	[5]830	577	66	187
1968	24,669	3,493	3,493	17,429	8,580	8,849	2,149	1,573	55	390	131	719	719	[5]879	608	73	198
1969	25,686	3,503	3,503	18,308	8,451	9,857	[5]2,220	1,596	60	420	145	725	725	930	640	81	209
1970	26,047	3,855	3,855	18,062	7,779	10,283	2,335	1,648	61	461	165	737	737	[5]1,058	745	90	223
1971	26,745	4,156	4,156	18,311	7,666	10,645	[5]2,500	1,724	70	529	177	716	716	[5]1,062	720	102	240
1972	28,415	4,482	4,482	19,383	8,057	11,326	2,676	1,839	76	576	186	764	764	[5]1,110	746	108	257
1973	30,417	4,619	4,619	20,921	8,225	12,696	2,940	2,041	86	613	200	817	817	1,120	735	114	271
1974	32,322	4,815	4,815	22,369	8,332	14,037	3,021	2,033	88	673	219	865	866	1,252	852	120	280
1975 .... (est.)	35,209	5,302	5,302	24,250	9,150	15,100	3,395	2,281	110	746	251	987	987	1,275	880	125	300
1976 .... (est.)	38,090	5,600	5,600	26,500	10,200	16,300	3,660	2,460	120	815	276	1,080	1,080	1,250	800	130	320

[1] All data are based on reports by performers.

[2] Expenditures for Federally Funded Research and Development Centers administered by both industry and by nonprofit institutions are included in the totals of the respective sectors.

[3] FFRDC's administered by individual universities and colleges and by university-consortia.

[4] Includes State and local government funds.

[5] Estimates derived from related information because either no sector survey was conducted for this year or this item was not obtained in survey.

Table B–2. Transfers of funds expended annually for performance of basic research by sector, distributed by source, 1953–76[1]

[Dollars in millions]

Year	Total basic research	Federal Government		Industry[2]			Universities and colleges					Associated FFRDC's[3]		Other nonprofit institutions[2]			
			Source		Sources			Sources					Source		Sources		
		Total funds used	Federal Government	Total funds used	Federal Government	Industry[4]	Total funds used	Federal Government	Industry	Universities and colleges[4]	Other nonprofit institutions	Total funds used	Federal Government	Total funds used	Federal Government	Industry	Other nonprofit institutions[4]
1953	426	101	101	151	$19	$132	$110	73	12	10	15	33	33	31	8	4	19
1954	478	102	102	$166	23	143	136	90	14	15	17	39	39	$35	11	4	20
1955	530	90	90	$189	27	162	$159	103	16	21	19	49	49	$43	17	6	21
1956	661	104	104	253	$37	$216	$200	130	18	30	22	51	51	$53	23	5	25
1957	760	122	122	271	$41	$230	$240	156	21	39	25	65	65	62	25	5	32
1958	864	126	126	295	$43	$252	281	176	24	50	29	78	78	$84	35	6	43
1959	1,030	173	173	320	$72	$248	$343	226	24	60	33	92	92	$102	46	8	48
1960	1,183	160	160	376	$79	$297	$433	299	24	72	38	97	97	$117	58	10	49
1961	1,378	206	206	395	$81	$314	$536	382	25	85	44	115	116	$126	57	11	58
1962	1,695	251	251	488	143	345	$659	481	25	102	51	136	136	$161	60	12	69
1963	1,974	299	299	522	147	375	$814	610	25	121	58	159	159	$180	66	14	71
1964	2,301	364	364	549	165	384	1,003	767	25	144	67	191	191	194	108	15	71

Table B–2. Transfers of funds expended annually for performance of basic research by sector, distributed by source, 1953–76[1] – Cont.

[Dollars in millions]

Year	Total basic research	Federal Government		Industry[2]			Universities and colleges					Associated FFRDC's[3]		Other nonprofit institutions[2]			
			Source		Sources			Sources					Source		Sources		
		Total funds used	Federal Government	Total funds used	Federal Government	Industry[4]	Total funds used	Federal Government	Industry	Universities and colleges[4]	Other nonprofit institutions	Total funds used	Federal Government	Total funds used	Federal Government	Industry	Other nonprofit institutions[4]
1965	2,572	424	424	592	186	406	[5]1,138	879	25	164	69	208	208	[5]210	120	16	74
1966	2,825	445	445	624	173	451	1,303	1,009	27	196	71	227	227	[5]226	132	18	76
1967	3,029	472	472	629	202	427	[5]1,457	1,124	31	223	79	250	250	[5]221	125	19	77
1968	3,286	502	502	642	180	462	1,649	1,251	36	276	86	276	276	[5]217	118	20	79
1969	3,378	565	565	618	160	458	[5]1,707	1,276	39	298	95	275	275	213	111	22	80
1970	3,521	646	646	602	158	444	1,796	1,296	40	360	110	269	269	[5]208	100	25	83
1971	3,515	535	535	581	125	456	[5]1,914	1,349	46	400	119	260	260	[5]225	110	25	90
1972	3,702	607	607	579	127	452	2,021	1,416	51	428	126	250	250	[5]245	125	25	95
1973	3,816	585	585	621	136	485	2,058	1,459	60	416	123	297	297	255	130	30	95
1974	4,072	661	661	683	159	524	2,154	1,524	61	430	139	300	300	274	144	30	100
1975 .... (est.)	4,446	736	736	725	160	565	2,397	1,680	70	476	181	308	308	280	136	36	110
1976 .... (est.)	4,750	750	750	775	170	605	2,600	1,826	76	525	175	335	335	290	130	35	125

[1]All data are based on reports by performers.

[2]Expenditures for Federally Funded Research and Development Centers administered by both industry and by nonprofit institutions are included in the totals of the respective sectors.

[3]FFRDC's administered by individual universities and colleges and by university-consortia.

[4]Includes State and local government funds.

[5]Estimates derived from related information because either no sector survey was conducted for this year or this item was not obtained in survey.

Table B–3. Transfers of funds expended annually for performance of applied research by sector, distributed by source: 1953–76[1]

[Dollars in millions]

Year	Total applied research	Federal Government		Industry[2]			Universities and colleges					Associated FFRDC's[3]		Other nonprofit institutions[2]			
			Source		Sources			Sources					Source		Sources		
		Total funds used	Federal Government	Total funds used	Federal Government	Industry[4]	Total funds used	Federal Government	Industry	Universities and colleges[4]	Other nonprofit institutions	Total funds used	Federal Government	Total funds used	Federal Government	Industry	Other nonprofit institutions[4]
1953	1,301	$345	345	$726	288	438	$130	57	6	57	10	44	44	56	36	11	9
1954	1,413	$349	349	$814	322	492	$137	61	7	59	10	51	51	$62	39	13	10
1955	1,506	$310	310	$928	368	560	$136	58	8	60	10	65	65	$67	41	15	11
1956	1,916	$356	356	1,268	$474	$794	$147	66	9	59	11	71	71	$74	43	17	14
1957	2,405	$417	417	1,670	$678	$992	$145	62	11	61	11	86	86	87	48	17	21
1958	2,730	$474	474	1,911	$774	$1,137	148	64	12	61	11	102	102	$95	64	17	24
1959	2,934	$558	558	1,991	$813	$1,178	$155	67	12	64	12	119	119	$111	67	18	26
1960	3,057	$595	595	2,029	$833	$1,196	$179	86	13	68	12	122	122	$132	87	19	26
1961	3,115	$634	634	1,977	$812	$1,165	$192	96	13	69	12	135	135	$177	125	19	33
1962	3,727	$702	702	2,449	1,011	1,438	$205	109	13	70	13	155	155	$216	150	22	44
1963	3,825	730	730	2,457	1,007	1,450	$227	128	14	72	13	170	170	$241	170	23	48
1964	4,238	928	928	2,600	1,040	1,560	232	127	14	77	14	202	202	276	228	22	46

Table B–3. Transfers of funds expended annually for performance of applied research by sector, distributed by source: 1953–76[1] – Cont.

[Dollars in millions]

Year	Total applied research	Federal Government		Industry[2]			Universities and colleges					Associated FFRDC's[3]		Other nonprofit institutions[3]			
			Source		Source			Source					Source		Source		
		Total funds used	Federal Government	Total funds used	Federal Government	Industry[4]	Total funds used	Federal Government	Industry	Universities and colleges[4]	Other nonprofit institutions	Total funds used	Federal Government	Total funds used	Federal Government	Industry	Other nonprofit institutions[4]
1965	4,470	1,030	1,030	2,658	1,038	1,620	[5]279	167	13	88	21	204	204	299	224	25	50
1966	4,747	1,047	1,047	2,843	1,039	1,804	328	194	13	88	32	207	207	[5]322	242	27	53
1967	4,968	1,102	1,102	2,915	1,066	1,849	[5]374	222	16	102	35	219	219	[5]358	265	31	62
1968	5,356	1,204	1,204	3,124	1,043	2,081	404	254	16	97	37	231	231	[5]393	286	35	70
1969	5,533	1,201	1,201	3,287	1,015	2,272	[5]406	245	16	105	40	210	210	429	311	39	79
1970	5,919	1,378	1,378	3,426	1,049	2,377	427	268	16	98	45	216	216	[5]472	347	40	85
1971	6,076	1,477	1,477	3,413	974	2,439	[5]474	292	16	115	48	210	210	[5]502	360	47	95
1972	6,276	1,481	1,481	3,471	941	2,530	546	346	19	132	50	226	226	[5]552	400	50	102
1973	6,829	1,613	1,613	3,739	975	2,764	715	461	22	166	66	226	226	536	376	50	111
1974	7,515	1,783	1,783	4,129	1,074	3,055	740	438	20	208	67	267	267	596	426	55	115
1975 .... (est.)	8,275	2,009	2,009	4,450	1,150	3,300	864	522	34	231	77	347	347	605	430	55	120
1976 .... (est.)	8,925	2,250	2,250	4,800	1,250	3,550	915	548	35	250	82	380	380	680	420	80	120

[1]All data are based on reports by performers.

[2]Expenditures for Federally Funded Research and Development Centers administered by both industry and by nonprofit institutions are included in the totals of the respective sectors.

[3]FFRDC's administered by individual universities and colleges and by university-consortia.

[4]Includes State and local government funds.

[5]Estimates derived from related information because either no sector survey was conducted for this year or this item was not obtained in survey.

Table B–4. Transfers of funds expended annually for performance of development by sector, distributed by source: 1953–76[1]

[Dollars in millions]

Year	Total development	Federal Government		Industry[2]			Universities and colleges					Associated FFRDC's[3]		Other nonprofit institutions[3]			
			Source		Sources			Sources					Source		Sources		
		Total funds used	Federal Government	Total funds used	Federal Government	Industry[4]	Total funds used	Federal Government	Industry	Universities and colleges[4]	Other nonprofit institutions	Total funds used	Federal Government	Total funds used	Federal Government	Industry	Other nonprofit institutions[4]
1953	3,401	$564	564	$2,753	1,123	1,630	$15	8	1	5	1	44	44	25	16	5	4
1954	3,760	$569	569	$3,090	1,405	1,685	17	9	1	6	1	51	51	$33	17	8	8
1955	4,146	$505	505	$3,523	$1,785	$1,738	$17	8	1	7	1	66	66	$35	17	8	10
1956	5,798	$580	580	5,084	$2,817	$2,267	$25	15	2	7	1	72	72	$37	18	8	11
1957	6,626	$681	681	5,790	$3,616	$2,174	$25	12	2	9	2	89	89	41	21	8	12
1958	7,140	$774	774	6,183	$3,942	$2,241	27	12	3	10	2	113	113	$43	22	8	13
1959	8,420	$909	909	7,307	$4,750	$2,557	$28	13	3	10	2	127	127	$49	27	9	13
1960	9,311	$971	971	8,104	$5,169	$2,935	$34	18	3	11	2	141	141	$61	35	11	15
1961	9,853	$1,034	1,034	8,536	$5,347	$3,189	$35	20	2	11	2	160	160	$88	66	11	19
1962	10,004	$1,145	1,145	8,527	5,281	3,246	$40	23	2	13	2	179	179	$113	80	11	22
1963	11,294	1,250	1,250	9,651	6,116	3,535	$40	22	2	14	2	201	201	$152	115	11	26
1964	12,355	1,546	1,546	10,363	6,515	3,848	40	22	2	14	2	236	236	170	125	10	24

Table B–4. Transfers of funds expended annually for performance of development by sector, distributed by source: 1953–76[1] – Cont.

[Dollars in millions]

Year	Total development	Federal Government		Industry[2]			Universities and colleges					Associated FFRDC's[3]		Other nonprofit institutions[3]			
			Source		Sources			Sources					Source		Sources		
		Total funds used	Federal Government	Total funds used	Federal Government	Industry[4]	Total funds used	Federal Government	Industry	Universities and colleges[4]	Other nonprofit institutions	Total funds used	Federal Government	Total funds used	Federal Government	Industry	Other nonprofit institutions[4]
1965	13,049	1,639	1,639	10,935	6,516	4,419	[5]57	37	2	15	3	217	217	[5]201	154	12	35
1966	14,322	1,728	1,728	12,081	7,120	4,961	84	59	2	18	5	196	196	[5]233	172	14	47
1967	15,208	1,822	1,822	12,841	7,097	5,744	[5]90	63	2	20	5	204	204	[5]251	187	16	48
1968	16,027	1,787	1,787	13,663	7,337	6,326	96	68	3	17	8	212	212	[5]269	202	18	49
1969	16,775	1,737	1,737	14,403	7,276	7,127	[5]107	75	5	17	10	240	240	288	218	20	50
1970	16,607	1,831	1,831	14,034	6,572	7,462	112	84	5	13	10	252	252	[5]378	298	25	55
1971	17,154	2,144	2,144	14,317	6,567	7,750	[5]112	83	5	14	10	246	246	[5]335	250	30	55
1972	18,437	2,394	2,394	15,333	6,979	8,354	109	78	5	16	10	288	288	[5]313	220	33	60
1973	19,772	2,421	2,421	16,561	7,114	9,447	167	121	6	29	11	294	294	329	230	34	65
1974	20,735	2,371	2,371	17,557	7,098	10,459	127	71	6	27	13	298	298	382	282	35	65
1975 .... (est.)	22,488	2,557	2,557	19,075	7,840	11,235	134	78	6	39	13	332	332	390	285	35	70
1976 .... (est.)	24,415	2,600	2,600	20,925	8,780	12,145	145	80	10	40	15	365	365	380	270	35	75

[1] All data are based on reports by performers.

[2] Expenditures for Federally Funded Research and Development Centers administered by both industry and by nonprofit institutions are included in the totals of the respective sectors.

[3] FFRDC's administered by individual universities and colleges and by university-consortia.

[4] Includes State and local government funds.

[5] Estimates derived from related information because either no sector survey was conducted for this year or this item was not obtained in survey.

Table B–5. Sources of funds used for research and development, by sector: 1953–76[1]

[Dollars in millions]

Year	Current dollars					Constant 1972 dollars[2]				
	Total	Federal Government	Industry	Universities and colleges	Other nonprofit institutions	Total	Federal Government	Industry	Universities and colleges	Other nonprofit insitutions
1953	5,128	2,759	2,239	72	58	8,709	4,686	3,803	122	99
1954	5,651	3,138	2,367	80	66	9,467	5,257	3,965	134	111
1955	6,182	3,509	2,513	88	72	10,138	5,754	4,121	144	118
1956	8,375	4,859	3,336	96	84	13,315	7,725	5,304	153	134
1957	9,791	6,119	3,460	109	103	15,058	9,411	5,321	168	158
1958	10,734	6,791	3,700	121	122	16,249	10,280	5,601	183	185
1959	12,384	8,059	4,057	134	134	18,341	11,936	6,009	198	198
1960	13,551	8,752	4,508	149	142	19,734	12,745	6,565	217	207
1961	14,346	9,264	4,749	165	168	20,707	13,372	6,855	238	242
1962	15,426	9,926	5,114	185	201	21,865	14,069	7,249	262	285
1963	17,093	11,219	5,449	207	218	23,876	15,671	7,611	289	305
1964	18,894	12,553	5,880	235	226	25,985	17,264	8,087	323	311
1965	20,091	13,033	6,539	267	252	27,033	17,536	8,798	359	339
1966	21,894	13,990	7,317	303	284	28,523	18,226	9,532	395	370
1967	23,205	14,420	8,134	345	306	29,366	18,249	10,294	437	387
1968	24,669	14,952	8,997	391	329	29,876	18,108	10,896	474	398
1969	25,686	14,914	9,998	420	354	29,619	17,198	11,529	484	408
1970	26,047	14,764	10,434	461	388	28,510	16,160	11,421	505	425
1971	26,745	14,982	10,817	529	417	27,854	15,603	11,265	551	434
1972	28,415	15,887	11,509	576	443	28,415	15,887	11,509	576	443
1973	30,417	16,437	12,896	613	471	28,717	15,518	12,175	579	445
1974	32,322	16,897	14,253	673	499	27,816	14,541	12,266	579	429
1975 (est.)	35,209	18,577	15,335	746	551	15.5 (est.)	14,700	12,135	590	436
1976 (est.)	38,090	20,130	16,550	815	595	28,479	15,050	12,374	609	445

[1]Summary of R&D data in table B–1, by source.
[2]Based on GNP implicit price deflator.
SOURCE: National Science Foundation.

Table B–6. Sources of funds used for basic research, by sector: 1953–76[1]

[Dollars in millions]

Year	Current dollars					Constant 1972 dollars[2]				
	Total	Federal Government	Industry	Universities and colleges	Other nonprofit institutions	Total	Federal Government	Industry	Universities and colleges	Other nonprofit institutions
1953	426	234	148	10	34	724	397	251	17	58
1954	478	265	161	15	37	801	444	270	25	62
1955	530	286	183	21	40	869	469	300	34	66
1956	661	345	239	30	47	1,051	548	380	48	75
1957	760	408	256	39	57	1,169	627	394	60	88
1958	864	460	282	50	72	1,308	696	427	76	109
1959	1,030	609	280	60	81	1,525	902	415	89	120
1960	1,183	693	331	72	87	1,723	1,009	482	105	127
1961	1,378	841	350	85	102	1,989	1,214	505	123	147
1962	1,695	1,091	382	102	120	2,403	1,546	541	145	170
1963	1,974	1,310	414	121	129	2,757	1,830	578	169	180
1964	2,301	1,595	424	144	138	3,165	2,194	583	198	190
1965	2,572	1,817	448	164	143	3,461	2,445	603	221	192
1966	2,825	1,986	496	196	147	3,680	2,587	646	255	192
1967	3,029	2,173	477	223	156	3,833	2,750	604	282	197
1968	3,286	2,327	518	276	165	3,980	2,818	627	334	200
1969	3,378	2,386	519	298	175	3,895	2,751	598	344	202
1970	3,521	2,469	509	350	193	3,854	2,702	557	383	211
1971	3,515	2,379	527	400	209	3,661	2,478	549	417	218
1972	3,702	2,525	528	428	221	3,702	2,525	528	428	221
1973	3,816	2,607	573	418	218	3,603	2,461	541	395	206
1974	4,072	2,788	615	430	239	3,504	2,399	529	370	206
1975 (est.)	4,446	3,029	670	476	271	3,518	2,397	530	377	214
1976 (est.)	4,750	3,210	715	525	300	3,551	2,400	535	393	224

[1]Summary of basic research data in table B–2, by source.
[2]Based on GNP implicit price deflator.
SOURCE: National Science Foundation.

Table B–7. Sources of funds used for applied research, by sector: 1953–76[1]

[Dollars in millions]

Year	Current dollars					Constant 1972 dollars[2]				
	Total	Federal Government	Industry	Universities and colleges	Other nonprofit institutions	Total	Federal Government	Industry	Universities and colleges	Other nonprofit institutions
1953	1,301	770	455	57	19	2,210	1,308	773	97	32
1954	1,413	822	512	59	20	2,367	1,377	858	99	34
1955	1,506	842	583	60	21	2,470	1,381	956	98	34
1956	1,916	1,012	820	59	25	3,046	1,609	1,304	94	40
1957	2,405	1,292	1,020	61	32	3,699	1,987	1,569	94	49
1958	2,730	1,468	1,166	61	35	4,133	2,222	1,765	92	53
1959	2,934	1,624	1,208	64	38	4,345	2,405	1,789	95	56
1960	3,057	1,725	1,228	66	38	4,452	2,512	1,788	96	55
1961	3,115	1,804	1,197	69	45	4,496	2,604	1,728	100	65
1962	3,727	2,127	1,473	70	57	5,283	3,015	2,088	99	81
1963	3,825	2,205	1,487	72	61	5,343	3,080	2,077	101	85
1964	4,238	2,503	1,596	77	62	5,829	3,442	2,195	106	86
1965	4,470	2,653	1,658	88	71	6,015	3,570	2,231	118	96
1966	4,747	2,729	1,844	89	85	6,184	3,555	2,402	116	111
1967	4,968	2,874	1,895	102	97	6,287	3,637	2,398	129	123
1968	5,356	3,020	2,132	97	107	6,487	3,658	2,582	117	130
1969	5,533	2,982	2,327	105	119	6,380	3,439	2,683	121	137
1970	5,919	3,258	2,433	98	130	6,479	3,566	2,663	107	142
1971	6,076	3,313	2,505	115	143	6,328	3,450	2,609	120	149
1972	6,276	3,393	2,599	132	152	6,276	3,393	2,599	132	152
1973	6,829	3,650	2,836	166	177	6,447	3,446	2,677	157	167
1974	7,515	3,988	3,139	206	182	6,467	3,432	2,701	177	157
1975 (est.)	8,275	4,458	3,389	231	197	6,548	3,528	2,682	183	156
1976 (est.)	8,925	4,825	3,645	250	205	6,673	3,607	2,725	187	153

[1]Summary of applied research data in table B – 3, by source.
[2]Based on GNP implicit price deflator.
SOURCE: National Science Foundation.

Table B—8. Sources of funds used for development, by sector: 1953—76[1]

[Dollars in millions]

Year	Current dollars					Constant 1972 dollars[2]				
	Total	Federal Government	Industry	Universities and colleges	Other nonprofit institutions	Total	Federal Government	Industry	Universities and colleges	Other nonprofit institutions
1953	3,401	1,755	1,636	5	5	5,776	2,981	2,779	8	8
1954	3,760	2,051	1,694	6	9	6,299	3,436	2,838	10	15
1955	4,146	2,381	1,747	7	11	6,799	3,905	2,865	11	18
1956	5,798	3,502	2,277	7	12	9,218	5,568	3,620	11	19
1957	6,626	4,419	2,184	9	14	10,191	6,796	3,359	14	22
1958	7,140	4,863	2,252	10	15	10,808	7,361	3,409	15	23
1959	8,420	5,826	2,569	10	15	12,470	8,629	3,805	15	22
1960	9,311	6,334	2,949	11	17	13,559	9,224	4,294	16	25
1961	9,853	6,619	3,202	11	21	14,222	9,554	4,622	16	30
1962	10,004	6,708	3,259	13	24	14,180	9,508	4,619	18	34
1963	11,294	7,704	3,548	14	28	15,776	10,761	4,956	20	39
1964	12,355	8,455	3,860	14	26	16,992	11,628	5,309	19	36
1965	13,049	8,563	4,433	15	38	17,558	11,522	5,965	20	51
1966	14,322	9,275	4,977	18	52	18,658	12,083	6,484	23	68
1967	15,208	9,373	5,762	20	53	19,246	11,862	7,292	25	67
1968	16,027	9,606	6,347	17	57	19,410	11,634	7,687	21	69
1969	16,775	9,546	7,152	17	60	19,344	11,008	8,247	20	69
1970	16,607	9,037	7,492	13	65	18,178	9,892	8,201	14	71
1971	17,154	9,290	7,785	14	65	17,865	9,675	8,108	15	68
1972	18,437	9,959	8,392	16	70	18,437	9,959	8,392	16	70
1973	19,772	10,180	9,487	29	76	18,667	9,611	8,957	27	72
1974	20,735	10,120	10,500	37	78	17,844	8,709	9,036	32	67
1975 (est)	22,488	11,090	11,276	39	83	17,795	8,776	8,923	31	66
1976 (est.)	24,415	12,095	12,190	40	90	18,254	9,043	9,114	30	67

[1]Summary of development data in table B—4, by source.
[2]Based on GNP implicit price deflator.
SOURCE: National Science Foundation.

Table B—9. Trends in defense, space, and all other R&D outlays, by source: 1953—76

Year	Defense-space outlays as a percent of total R&D			Nondefense-nonspace outlays as a percent of total R&D		
	Total	Defense related	Space related	Total	Non-Federal	Federal
1953	49.0	48.2	.8	51.0	46.2	4.8
1954	49.8	48.9	.9	50.2	44.5	5.7
1955	49.2	48.2	1.0	50.8	43.2	7.6
1956	50.2	49.3	.9	49.8	42.0	7.8
1957	53.8	52.9	.9	46.2	37.5	8.7
1958	53.7	52.6	1.1	46.3	36.7	9.6
1959	56.6	54.0	2.6	43.4	34.9	8.5
1960	55.4	52.2	3.2	44.6	35.4	9.2
1961	55.5	49.9	5.6	44.5	35.4	9.1
1962	54.6	47.7	6.9	45.4	35.6	9.8
1963	55.1	41.3	13.8	44.9	34.4	10.5
1964	55.5	36.7	18.8	44.5	33.6	10.9
1965	53.6	32.9	20.7	46.4	35.1	11.3
1966	51.8	32.5	19.3	48.2	36.1	12.1
1967	49.1	34.9	14.2	50.9	37.9	13.0
1968	47.9	34.5	13.4	52.1	39.4	12.7
1969	45.4	34.1	11.3	54.6	41.9	12.7
1970	43.1	32.8	10.3	56.9	43.3	13.6
1971	40.9	31.6	9.3	59.1	44.0	15.1
1972	40.7	32.8	7.9	59.3	44.1	15.2
1973	38.7	32.0	6.7	61.3	45.9	15.4
1974	36.1	27.1	9.0	63.9	47.7	16.2
1975 (est.)	34.8	26.3	8.5	65.2	47.4	17.8
1976 (est.)	35.8	27.4	8.4	64.2	47.3	16.9

SOURCE: National Science Foundation

Table B—10. Full-time equivalent (FTE) scientists and engineers employed in research and development, by sector: selected years[1]

[In thousands]

Sector	1954	1958	1961	1965	1968	1969	1970	1971	1972	1973	1974	1975[2]
Total	237.1	354.6	425.7	494.1	550.4	558.2	549.6	529.8	521.9	521.1	527.2	530.5
Federal Government[3]	37.7	46.0	51.1	61.8	68.1	69.9	69.8	66.5	65.2	62.3	65.0	64.5
Industry[4 5]	164.1	256.1	312.0	348.4	381.9	385.6	375.5	358.4	353.3	357.4	357.9	358.0
Universities and colleges, total	25.0	36.5	42.4	53.4	66.0	68.3	68.5	68.4	66.5	64.8	66.7	71.0
Scientists and engineers	20.3	29.2	33.6	40.4	49.0	50.4	50.3	49.8	48.9	43.2	49.2	52.6
Graduate students[6]	4.7	7.3	8.8	13.0	17.0	17.9	18.2	18.6	17.6	16.6	17.5	18.4
University associated FFRDC's, total	5.0	8.1	9.1	11.1	11.2	11.6	11.5	11.5	11.7	12.0	12.1	12.8
Scientists and engineers	4.9	7.9	8.8	10.7	10.7	11.1	11.0	11.0	11.3	11.7	11.8	12.4
Graduate students[6]	.1	.2	.3	.4	.4	.5	.5	.5	.4	.3	.3	.4
Other nonprofit institutions[4 7]	5.3	7.9	11.1	19.4	23.2	22.8	24.3	25.0	25.2	24.6	25.5	24.2

[1]Number of full-time employees plus the FTE of part-time employees. Excludes scientists and engineers employed in State and local government agencies.

[2]Estimate.

[3]Includes both civilian and military service personnel and managers of R&D. Military R&D scientists and engineers in the Department of Defense were estimated at 7,000 in 1954, 8,400 in 1958, 9,200 in 1961, 12,000 in 1965, 13,000 in 1968, 14,000 in 1969 and 1970, 12,000 in 1971, 10,700 in 1972, 8,100 in 1973, 7,600 in 1974, and 7,700 in 1975.

[4]Includes professional R&D personnel employed at FFRDC's administered by organizations in the sector.

[5]Excludes social scientists.

[6]Numbers of FTE graduate students receiving stipends and engaged in R&D.

[7]Includes estimate for R&D scientists and engineers employed in State affiliated institutions such as hospitals, museums, etc.

NOTE: The figures for the industry sector represent yearly averages and may differ from other data in the text which is based upon surveys reporting the employment in a single month of the year. Data in the text exclude historians, political scientists, and other social scientists.

SOURCE: National Science Foundation.